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AUTHOR	Henderson, Paula
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ABSTRACT

This autoinstructional program deals with the study of energy relationships as they occur in the subject Ecology. It is recommended for study in grade 10 for middle level achievers. No prerequisites are listed. Behavioral objectives are suggested. The equipment needed to be used with the student script supplied is listed. Ten minutes is given as the suggested time needed. (EB)

ENERGY RELATIONSHIPS

Prepared By

Paula Henderson
Science Teacher
NEWARK SCHOOL DISTRICT

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TEACHER'S GUIDE

PACKET NUMBER	591.53 H
SUBJECT	Ecology
TITLE	Energy Relationships
GRADE	10
LEVEL	Middle
PREREQUISITES	None
BEHAVIORAL OBJECTIVES	1. To be able to describe the change in the relative amount of energy passed from one tropic level to the next 2. To be able to list the effect changing one factor can have on a food web. 3. To be able to define producer, first level consumer and decomposer in terms of an ecological cycle.
EQUIPMENT	Four slides Slide projector Tape recorder Cassette tape Work sheet
TIME	10 minutes
SAMPLE EVALUATION	Work sheet
SPACE REQUIRED	Carrel

SCRIPT

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Ecology has become a daily word. We hear it often in conversations and in news reports. Many people make false statements concerning ecology because they do not understand the basic processes involved. Often you hear statements like the following: Who cares if a species goes extinct? What difference does it make? or Why don't they just destroy all bacteria? It's of no use to us. Hopefully by the end of this A-T, you will understand why these statements are false.

No living things can exist without energy. LOOK AT SLIDE ONE. The main source of energy for living things is the sun. Plants are very successful in capturing this energy and transforming it into usable chemical energy through photosynthesis. As you have learned you can't destroy energy but you can change its form. When the sun's energy passes through the leaf approximately 10% of it ends up as chemical energy while the remainder is lost as heat energy. This 10% efficiency is fairly consistent throughout the process. When a mouse eats a plant, approximately 10% of the plant's energy becomes chemical energy to the mouse while 90% of it is lost as heat energy in the process of eating and digestion. For this reason, the mouse must consume a large quantity of plant material in order to obtain enough energy for its immediate use and to store in tissue for further use. This stored energy, in turn, becomes energy for the fox. Again, about 90% of the energy is lost as heat while the remaining 10% becomes part of the material composing the fox. About what percent of the sun's energy ends up as part of the fox's energy? Figure it out. The answer is about one tenth of one percent. For this reason, there obviously must be a much larger amount of plant material than animal to provide the necessary food energy for the entire system.

LOOK AT SLIDE TWO. This slide illustrates what you have just learned in a different fashion. The bottom row is the largest since the plants must trap all of the energy they and the animals need. Because they provide the energy for all living things, the plants are referred to as the producers. The next level is the first order consumers. These are animals that are herbivores, which means plant eating. Notice that there are less first order consumers than producers. The next level up has even less members. These second order consumers are

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carnivores which means they eat meat. It takes several first order consumers to provide the food energy that one second order consumer needs. At the top of this pyramid is man. Here, he is a third order consumer. From this you should get the idea that consumers are not fixed to one steady order. It depends on what we're eating. When man eats a carrot, he is a first order consumer. When he eats a steak, he's second order since the cow is a first order consumer of the plants it grazed on.

Let's look at this process from another side. LOOK AT SLIDE THREE. Here you see the cycle of dependence that is present among living things. First of all, the plants produce the energy containing compounds through photosynthesis. Next, these plant compounds are consumed by the first order consumers. Which organism would that be on this slide? I hope your answer was the grasshopper. It's a herbivore which feeds on the plants shown here. The brown thrasher would then be a second order consumer feeding on the grasshopper and the hawk a third order consumer feeding on the thrasher. Eventually the plants and animals die. It would be very inefficient of nature if the cycle ended here since eventually all our new materials would be locked up in the compounds that had formed these organisms. It is the job of the decomposers to turn these dead organisms back into usable materials. This is where the bacteria are of great importance. They break the compounds that were once in plants and animals, back into raw materials such as carbon dioxide and simple nitrogen compounds. Now these raw materials can be used in making new producers and the cycle continues. As a matter of fact the bacteria produce 95% of the carbon dioxide present in the atmosphere. Life could not go on without these important little organisms.

LOOK AT SLIDE FOUR. In nature, the ecological balance is based on inter-relationships more complicated than the simple food chains used here to describe energy relationships. This slide shows a food web. In a food web, an organism's balance is dependent upon that of several others. It is possible therefore if one animal's population falls or is killed off that another type of animal you never considered related to the first would suffer or change in balance due to the inter-relationship in a food web. For instance, in this simple web shown here, if a poison were introduced to the area that killed all the mice

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you may not expect the mountain lion population to be affected. They would be, however, in at least two ways evident in this slide. First of all, in this simple web, the mountain lions feed on shrews which are shown here only feeding on mice. If the mouse population was wiped out, what would happen to the shrews? If they had nothing else to eat they too would be eliminated and so would one of the sources of food for the mountain lions. Now look at another source of lion food - the rabbits. Rabbits are also shown to be food for snakes and owls who in turn both eat mice. If the mice were reduced, these two predators would have to turn to another food source more heavily than on normal occasions - that is, on the rabbits. The hungry mountain lions also would be competing more keenly for rabbits. Imagine how the rabbits feel about all this! If you study the slide more closely you can probably come up with several other examples of how this web can be affected by eliminating one organism at a time.

I hope you now have a basic understanding of some of the ecological relationships found in basic natural situations. The ecologist must deal with these daily in order to try and gauge the effects man is having on his environment. It is important to remember that man, the animal, is not separate, but is very much entwined in the food web of his community.

Now that you have finished, your task is to do the following problem. Using slide four, imagine that the local housewives got together and agreed to pay the children one dollar for each dead snake they brought home from the surrounding forest and fields. Make a list of ten effects that this might have on the food web shown here. Make sure your examples are clearly explained. When you have finished, rewind the tape, give the paper to your teacher, and leave the carrel as you found it.

List ten effects that eliminating the snake population from the food web seen in slide four might have. Hand in that sheet to your teacher when it is completed.